

In re: Jung-Hun Seo et al.
Serial No.: 10/620,995
Filed: July 16, 2003
Page 6 of 8

REMARKS

This response is submitted in reply to the Office Action mailed on November 26, 2004 (hereinafter "Office Action"). Claims 1-31 are pending in the application. In response to the restriction requirement, Applicants confirm election of Invention I, Species 1, Claims 1-19, without traverse. Claims 20-31 are canceled without prejudice thereto for pursuit in a divisional application(s). Applicants respectfully traverse the rejections of Claims 1-19 based on US Patent No. 6,391,769 to Lee et al. (hereinafter "Lee") for at least the reasons discussed below.

Independent Claim 1 is patentable over Lee

Independent Claim 1 stands rejected as anticipated by Lee. In particular, the Office Action cites column 8, lines 10-15 of Lee as disclosing "plasma treating the substrate having the metal-containing layer thereon." Office Action, pp. 4-5. This passage states:

The process of annealing the barrier metal layer 109 is performed at 400~550° C. in a N₂ atmosphere for 30-60 minutes, or at 550~850° C. in a NH₃ atmosphere through rapid thermal processing (RTP). Preferably, the RTP is performed for 10-120 seconds. Also, the RTP may be performed in N₂ atmosphere, rather than in NH₃ atmosphere.

Nothing in this passage discloses or suggests *plasma* treatment. As is known in the art, RTP generally is a process wherein a temperature of a wafer is rapidly increased and maintained at a target temperature for a short period of time, and plasma treatment is neither explicitly or implicitly included in the RTP process described in the cited passage from Lee. In light of this, Applicants submit that Lee does not disclose or suggest all of the recitations of Claim 1 and, for at least this reason, Claim 1 is patentable over Lee.

The dependent claims are patentable

Applicants submit that dependent Claims 2-19 are patentable at least by virtue of depending from patentable independent Claim 1. Applicants further submit that several of the dependent claims are separately patentable. For example, Claim 10 recites " plasma

treating the substrate at a pressure in a range from about 1 Torr to about 6 Torr." In rejecting Claim 10, the Office Action cites Lee, column 11, lines 35-40. Office Action, p. 6. However, this passage from Lee describes the formation conditions for a vapor deposition process for forming a metal plug that fills a lined recess, not a plasma treatment process for "a metal-containing layer conforming to a surface of the recess and to an adjacent surface of the substrate." Accordingly, the cited passage from Lee does not disclose or suggest these recitations of Claim 10, and for at least this reason, Claim 10 is separately patentable.

Claim 11 recites "plasma treating the substrate at a power level in a range from about 600 W to about 1,000 W." In rejecting Claim 11, the Office Action concedes that Lee does not disclose a plasma treatment power level, but asserts that "the selection of the power level is obvious." Office Action, p. 9. However, as noted above, Lee does not teach or suggest the recited plasma treatment, much less the power level at which such treatment occurs. Accordingly, Lee does not disclose or suggest these recitations of Claim 11 and, for at least this reason, Claim 11 is separately patentable.

Claim 12 recites "plasma treating the substrate for about 60 seconds." In rejecting Claim 12, the Office Action again recites column 8, lines 10-15 of Lee. Office Action, p. 6. However, as noted above, this passage does not teach plasma treatment and, therefore, does not teach the recited plasma treatment time. Accordingly, Lee does not disclose or suggest these recitations of Claim 12 and, for at least this reason, Claim 12 is separately patentable.

Claim 18 has been amended to recite "plasma treating the substrate under conditions sufficient to cause aluminum to deposit at a greater rate on a portion of the metal-containing layer within the recess than on a portion of the metal-containing layer adjacent the recess during the depositing of aluminum on the metal-containing layer." In rejecting Claim 18, the Office Action cites column 8, lines 25-30 of Lee, which describes use of a material layer 111 using a DC magnetron sputtering apparatus, which, as described at column 8, lines 30-36 of Lee, can "prevent formation of the material layer in the recessed region." This is an entirely different approach to achieving different deposition thickness in the recess and on surrounding surfaces than the plasma-treatment based approach of Claim 18. Accordingly,

In re: Jung-Hun Seo et al.
Serial No.: 10/620,995
Filed: July 16, 2003
Page 8 of 8

Lee does not disclose or suggest these recitations of Claim 18 and, for at least this reason, Claim 18 is separately patentable.

Conclusion

Applicants submit that the present application is in condition for allowance for at least the reasons discussed above, and respectfully requests allowance of the claims and passing of the application to issue. Should the Examiner have any matters outstanding of resolution, she is encouraged to telephone the undersigned at 919-854-1400 for expeditious handling.

Respectfully submitted,




Robert M. Meeks
Registration No. 40,723

USPTO Customer No. 20792
Myers Bigel Sibley & Sajovec
Post Office Box 37428
Raleigh, North Carolina 27627
Telephone: 919/854-1400
Facsimile: 919/854-1401

Certificate of Mailing under 37 CFR 1.8 (or 1.10)

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on February 24, 2005



Candi L. Riggs